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# Review of Various Technologies for Solar Vegetable Cart

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***Abstract:*** ***The solar vegetable cart is a sustainable and environmentally friendly solution for the transportation and sale of fresh produce. This innovative cart is equipped with solar panels, which power a refrigeration system that keeps vegetables fresh and nutritious. The cart is designed to be lightweight, easy to manage, and customizable to suit the needs of individual farmers or vendors. By harnessing the power of the sun, the solar vegetable cart reduces reliance on non-renewable energy sources and minimizes carbon emissions. It is an ideal solution for farmers markets, street vendors, and mobile grocers who want to provide fresh, healthy produce to their customers while reducing their environmental impact.***

## I. INTRODUCTION

As the world becomes increasingly conscious about environmental sustainability, there has been a growing interest in developing environmentally friendly technologies. One such technology is the solar-powered vegetable cart. This innovative solution has gained significant traction among farmers and vendors alike as it offers a sustainable and cost-effective way of transporting produce. However, with the growing demand for such carts, there are various technologies available in the market, each with its own set of features and benefits. In this review, we will explore and evaluate some of the most popular technologies for solar vegetable carts, with a focus on their efficiency, durability, and affordability. Mobile venders are struggling to keep their vegetables and fruits fresh to sell and this problem is most likely due to lack of sufficient storage and cooling facilities after purchasing from wholesale market results in deterioration of fresh fruits and vegetables. By studying different research papers, we have found that, the shelf life of vegetables can vary depending on the type of vegetable and the storage conditions. Generally, vegetables have a short shelf life due to their high moisture content and vulnerability to microbial spoilage. However, there are several methods to increase the shelf life of vegetables, including: proper harvesting, temperature control, chemical treatment, cleaning and disinfecting.

Through our studies we have found that there are different methods available for cooling aside from common refrigeration system like forced air cooling, hydrocooling vacuum cooling, evaporative cooling. Evaporative cooling is a method that uses the natural process of evaporation to cool vegetables. This method involves placing the vegetables in a cooler or a refrigerated room, and then circulating cool air over a wet surface, such as a pad or a screen. The cool air absorbs moisture from the wet surface, which lowers its temperature. This method is particularly useful for vegetables that require high humidity levels, such as mushrooms and sprouts In conclusion there are many methods available, but we have chosen evaporative cooling system as it fulfils our desirables. Previous studies have investigated implementation of evaporative cooling chamber on locomotive vending cart; however, a gap exists in the literature regarding motorizing the vending cart. To date, there has been limited research on its locomotion operation, despite the potential implications to ease up the human efforts by pulling the cart through motor implication. While some studies have touched on this topic, there remains a lack of empirical research that specifically addresses said problem above in a comprehensive manner.

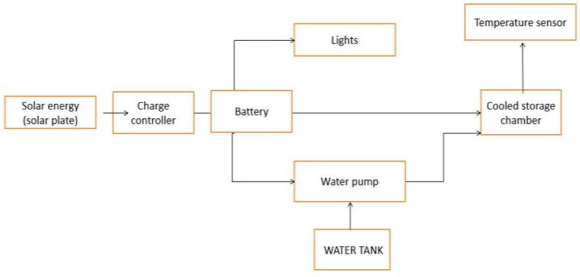



Fig: 1 General block diagram

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## II. RELATED WORK

1) "Solar powered portable food warmer and cooler based on peltier effect", Pavan Attavane, etal, has suggested the advancement in electronics has escalated the progress that is being made in semiconductor industries and has become one of the prime factors of dependency in today's world. Minimal power consumption and miniaturization of the semiconductor chips are the major features that lead the table of why this industry is a top notch one. During the course of time, various branches of science have joined hands to make bigger technological advancements. One of the most popular combinations being Mechanical and Electronics, called Mechatronics. Refrigerator system is one such example where miniaturization is made possible with the usage of advanced semiconductors, which also concentrates on reduced power consumption. Amongst the numerous ways, utilization of Peltier Module is the most favorable one as per our research. In this paper, we aim at presenting a preponderant, propitious and a simple solution for performing both cooling (Refrigeration) and heating effects in a more efficient manner by the utilization of solar energy. The Peltier module is more efficient, static and easy to handle. It is reliable and eco-friendly. A prototype has been designed and realized accordingly. All the parameters of the system are experimentally obtained and the measurements are acquiescent with the conventional one.
2) "Solar Powered Golf Cart: Testing and Performance Analyses", Jiang Fan, etal, has suggested an electric golf cart powered by deep cycle, rechargeable lead-acid battery bank is commonly used to carry the golfers and their golf clubs around a golf course at speed not higher than 25km/h. In operation, the cart batteries need to be charged regularly by the mains, which does not only waste energy but also results in short battery lifespan of 1.5 to 3 years. To prolong the lifetime of cart battery, conserve energy and mitigate CO2 emission, a golf cart can be equipped with solar PV system to harvest solar energy to drive the cart. This paper presents the on-site tests on a 2-seater solar golf cart powered by 420Wp solar PV system and running under tropic weather conditions. Analyses on the testing results show that a solar powered golf cart can not only improve the lifespan of cart battery but also conserve energy and reduce CO2 emission.
3) **"**Solar-Powered Evaporatively Cooled Vegetable Vending Cart", D.V.K. Samuel, etal, has suggested a solar-powered vending cart was designed and developed for storage of fruits and vegetables. It was tested for its performance during summer season. The minimum and maximum drop in temperature ranged between 8.1 degrees C and 11.2 degrees C, and the increase in relative humidity was observed to be up to 15% and 25% inside the vending card chamber in June. The requirement of water ranged between 16.5 and 20.0 litre/day. There was considerable effect on physiological loss in weight of different vegetables kept either inside or outside the mobile chamber. The freshness and shelf-life of vegetables increased substantially after storage in the cart.
4) "Energy Efficient Hybrid Solar System for Cold Storage in Remote Areas", Dr. R. S. Bharj, etal, has suggested —Standalone PV systems have shown to be reliable and cost effective for cooling & refrigeration and have attracted the users. For a specific application with an estimated requirement of cooling in cold storage, low power air conditioning system using PV modules has been designed, fabricated and developed. The paper also deals with our experiences encountered including the successful operation of the refrigeration system during off the sunshine hours continuously for 7 or 8 hours. The calculations of the specific cooling costs show the promising economic effectiveness and reliability of the designed PV refrigeration system. Keeping in view of the technical performance and economic parameter, it demonstrates that this small-scale technology can contribute to solving problems of cooling like small area refrigeration including the transportable and small cold storage container with integrated PV energy supply systems. These systems can be erected on or around a cold storage to obtain the cooling needs while grid electricity cuts frequently or especially in remote desert areas.
5) "Electric Motor Drive Selection Issues for HEV Propulsion Systems: A Comparative Study" M. Zeraoulia, etal, has suggested this paper describes a comparative study allowing the selection of the most appropriate electric propulsion system for a parallel Hybrid Electric Vehicle (HEV). This study is based on an exhaustive review of the state of the art and on an effective comparison of the performances of the four main electric propulsion systems that are the dc motor, the induction motor, the permanent magnet synchronous motor, and the switched reluctance motor. The main conclusion drawn by the proposed comparative study is that it is the cage induction motor that better fulfils the major requirements of the HEV electric propulsion.

## III. CONCLUSION

Through our investigation we have studied about different cooling methods, their efficiencies, different cooling materials available to us and reached to the following conclusions:

*1)* The solar-powered vegetable cart using evaporative cooling presents an innovative solution for food vendors in areas without reliable electricity. This study has demonstrated the effectiveness of using evaporative cooling to extend the shelf life of vegetables while using renewable energy from the sun. The results showed that the use of a solar-powered fan and water pump significantly reduced the temperature of the vegetables and increase the shelf life upto 3 days.

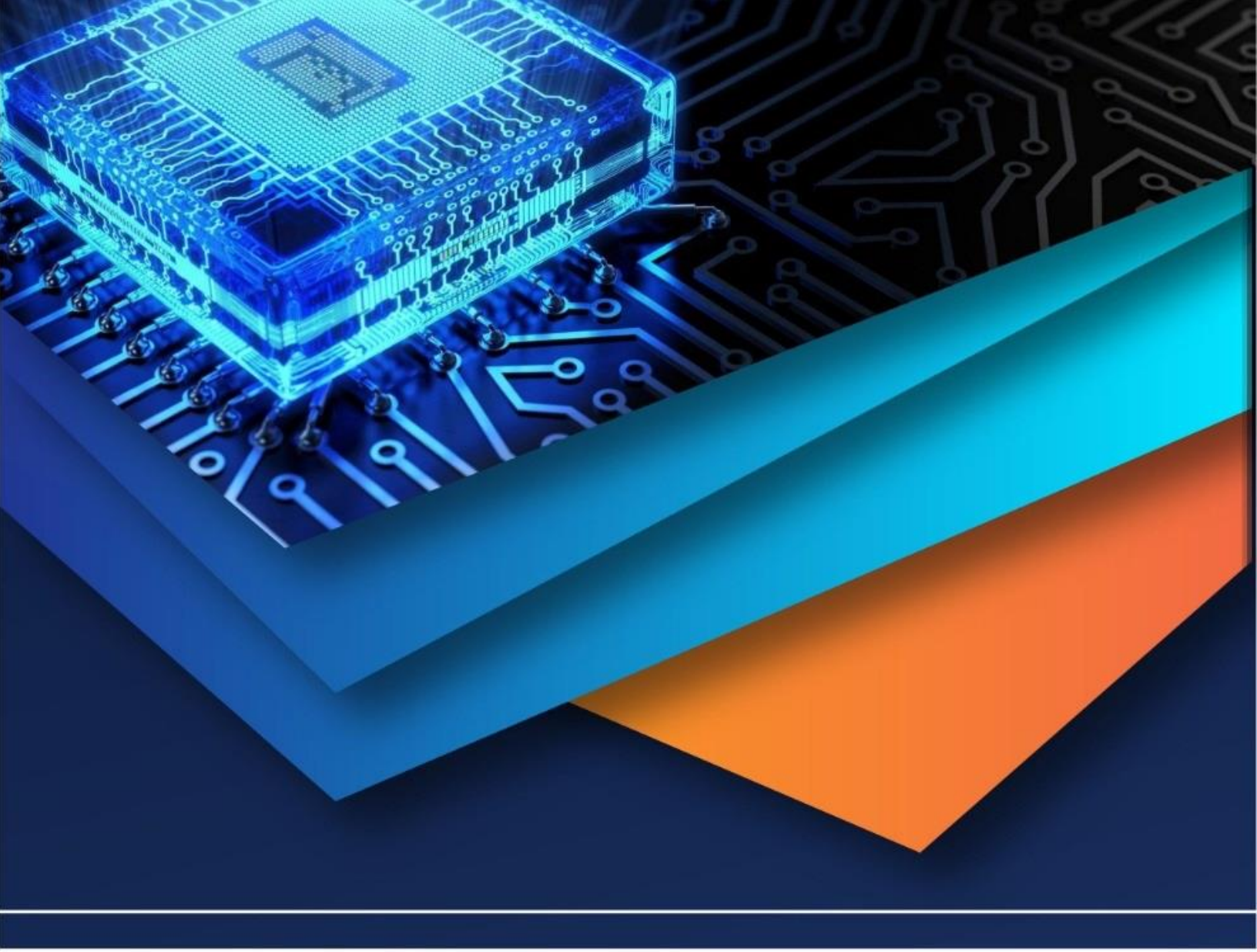
*2)* The implementation of this technology can improve the livelihoods of small scale food venders, reduce food waste and contribute to the sustainable development of local communities.

*3)* This review paper provides insights into the use of solarpowered evaporative cooling in the food sector and its potential to improve food security and sustainability. Further research is needed to address the limitations and explore the opportunities for scaling up this technology to benefit more communities worldwide.

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